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Pony #7/C

SEQUENCE LISTING

<110> Gotschlich, Emil C.
<120> GLYCOSYLTRANSFERASES FOR BIOSYNTHESIS OF OLIGOSACCHARIDES, AND GENES ENCODING THEM
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<140> 10/007,267
<141> 2001-12-03

<150> US 09/333,412
<151> 1999-06-15

<150> US 08/878,360
<151> 1997-06-18

<150> US 08/683,426
<151> 1996-07-18

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<151> 1994-09-24

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<170> PatentIn version 3.2

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<213> Neisseria gonorrhiae

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35 40 45

Ala Leu Tyr Ala Ala Ala Gln Gly Leu Gln Pro Lys Ile Ala Ala Ala
50 55 60

Val Ala Glu Gly Asn Phe Arg Thr Ala Leu Ser Glu Leu Ala Ser Val
65 70 75 80

Lys Pro Gln Val Asp Ala Phe Phe Asp Gly Val Met Val Met Ala Glu
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Ile Ala Lys Asp Phe Gln Lys Arg Asp Ser Arg Ile Lys Ile Leu Ala
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Gln Ala Gln Asn Ser Gly Leu Ile Pro Ser Leu Asn Ile Gly Leu Asp
65 70 75 80

Glu Leu Ala Lys Ser Gly Gly Gly Gly Glu Tyr Ile Ala Arg Thr
85 90 95

Asp Ala Asp Asp Ile Ala Ser Pro Gly Trp Ile Glu Lys Ile Val Gly
100 105 110

Glu Met Glu Lys Asp Arg Ser Ile Ile Ala Met Gly Ala Trp Leu Glu
115 120 125

Val Leu Ser Glu Glu Lys Asp Gly Asn Arg Leu Ala Arg His His Lys
130 135 140

His Gly Lys Ile Trp Lys Lys Pro Thr Arg His Glu Asp Ile Ala Ala
145 150 155 160

Phe Phe Pro Phe Gly Asn Pro Ile His Asn Asn Thr Met Ile Met Arg
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Arg Ser Val Ile Asp Gly Gly Leu Arg Tyr Asp Thr Glu Arg Asp Trp
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Ala Glu Asp Tyr Gln Phe Trp Tyr Asp Val Ser Lys Leu Gly Arg Leu
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Ala Tyr Tyr Pro Glu Ala Leu Val Lys Tyr Arg Leu His Ala Asn Gln
210 215 220

Val Ser Ser Lys His Ser Val Arg Gln His Glu Ile Ala Gln Gly Ile
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Pro Glu Asp Phe Ala Gly Phe Pro Leu Asn Ile Arg His Ile Ser Ile			
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Gly Leu Phe Lys Gly Gly Val Cys Tyr Ala Asn Ser Arg Phe Asn Phe
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Met Pro Thr Asn Tyr Ala Phe Met Ala Asn Gly Phe Ala Ser Arg His
210 215 220

Thr Asp Pro Leu Tyr Leu Asp Arg Thr Asn Thr Ala Met Pro Val Ala
225 230 235 240

Val Ser His Tyr Cys Gly Ser Ala Lys Pro Trp His Arg Asp Cys Thr
245 250 255

Val Trp Gly Ala Glu Arg Phe Thr Glu Leu Ala Gly Ser Leu Thr Thr
260 265 270

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Ile Tyr
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Asn Pro Arg Asn Leu Gly Phe Ile Ala Ser Leu Asn Ile Gly Leu Asp
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Pro Phe Gly Asn Pro Ile His Asn Asn Thr Met Ile Met Arg Arg Ser
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Val Ile Asp Gly Gly Leu Arg Phe Asp Pro Ala Tyr Ile His Ala Glu
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Asp Tyr Lys Phe Trp Tyr Glu Ala Gly Lys Leu Gly Arg Leu Ala Tyr
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Tyr Pro Glu Ala Leu Val Lys Tyr Arg Phe His Gln Asp Gln Thr Ser
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Ser Lys Tyr Asn Leu Gln Gln Arg Arg Thr Ala Trp Lys Ile Lys Glu
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Glu Ile Arg Ala Gly Tyr Trp Lys Ala Ala Gly Ile Ala Val Gly Ala
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Asp Cys Leu Asn Tyr Gly Leu Leu Lys Ser Thr Ala Tyr Ala Leu Tyr
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Glu Lys Ala Leu Ser Gly Gln Asp Ile Gly Cys Leu Arg Leu Phe Leu
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Tyr Glu Tyr Phe Leu Ser Leu Glu Lys Tyr Ser Leu Thr Asp Leu Leu
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325 330 335

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Cys Phe Met Ser His Ala Val Leu Trp Glu Gln Ala Leu Asp Glu Gly
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Leu Pro Tyr Ile Ala Val Phe Glu Asp Asp Val Leu Leu Gly Glu Gly
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Ala Glu Gln Phe Leu Ala Glu Asp Thr Trp Leu Glu Glu Arg Phe Asp
100 105 110

Lys Asp Ser Ala Phe Ile Val Arg Leu Glu Thr Met Phe Ala Lys Val
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Ile Val Arg Pro Asp Lys Val Leu Asn Tyr Glu Asn Arg Ser Phe Pro
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Leu Leu Glu Ser Glu His Cys Gly Thr Ala Gly Tyr Ile Ile Ser Arg
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Glu Ala Met Arg Phe Phe Leu Asp Arg Phe Ala Val Leu Pro Pro Glu
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Arg Ile Lys Ala Val Asp Leu Met Met Phe Thr Tyr Phe Phe Asp Lys
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Leu His Tyr Ala Lys Phe Leu Ser Gln Asn Ser Met Leu Gly Ser Asp
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Leu Glu Lys Asp Arg Glu Gln Gly Arg Arg His Arg Arg Ser Leu Lys
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Val Met Phe Asp Leu Lys Arg Ala Leu Gly Lys Phe Gly Arg Glu Lys
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<211> 279

<212> PRT

<213> Neisseria gonorrhoeae

<400> 8

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His Ile Ala Ala Thr Phe Gly Ser Arg Gly Ile Pro Phe Gln Phe Phe
20 25 30

Asp Ala Leu Met Pro Ser Glu Arg Leu Glu Arg Ala Met Ala Glu Leu
35 40 45

Val Pro Gly Leu Ser Ala His Pro Tyr Leu Ser Gly Val Glu Lys Ala
50 55 60

Cys Phe Met Ser His Ala Val Leu Trp Glu Gln Ala Leu Asp Glu Gly
65 70 75 80

Val Pro Tyr Ile Ala Val Phe Glu Asp Asp Val Leu Leu Gly Glu Gly
85 90 95

Ala Glu Gln Phe Leu Ala Glu Asp Thr Trp Leu Gln Glu Arg Phe Asp
100 105 110

Pro Asp Ser Ala Phe Val Val Arg Leu Glu Thr Met Phe Met His Val
115 120 125

Leu Thr Ser Pro Ser Gly Val Ala Asp Tyr Gly Gly Arg Ala Phe Pro
130 135 140

Leu Leu Glu Ser Glu His Cys Gly Thr Ala Gly Tyr Ile Ile Ser Arg
145 150 155 160

Lys Ala Met Arg Phe Phe Leu Asp Arg Phe Ala Val Leu Pro Pro Glu
165 170 175

Arg Leu His Pro Val Asp Leu Met Met Phe Gly Asn Pro Asp Asp Arg
180 185 190

Glu Gly Met Pro Val Cys Gln Leu Asn Pro Ala Leu Cys Ala Gln Glu
195 200 205

Leu His Tyr Ala Lys Phe His Asp Gln Asn Ser Ala Leu Gly Ser Leu
210 215 220

Ile Glu His Asp Arg Arg Leu Asn Arg Lys Gln Gln Trp Arg Asp Ser
225 230 235 240

Pro Ala Asn Thr Phe Lys His Arg Leu Ile Arg Ala Leu Thr Lys Ile
245 250 255

Gly Arg Glu Arg Glu Lys Arg Arg Gln Arg Arg Glu Gln Leu Ile Gly
260 265 270

Lys Ile Ile Val Pro Phe Gln
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<211> 21

<212> DNA

<213> Artificial Sequence

<220>

<223> PCR primer

<400> 9

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21

<210> 10

<211> 22

<212> DNA

<213> Artificial Sequence

<220>

<223> PCR primer

<400> 10

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22

<210> 11

<211> 348

<212> PRT

<213> non-Neisseria

<400> 11

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Tyr Phe Ala Gln Ser Leu Ala Ala Val Val Asn Gln Thr Trp Arg Asn
20 25 30

Leu Asp Ile Leu Ile Val Asp Asp Gly Ser Thr Asp Gly Thr Leu Ala
35 40 45

Ile Ala Lys Asp Phe Gln Lys Arg Asp Ser Arg Ile Lys Ile Leu Ala
50 55 60

Gln Ala Gln Asn Ser Gly Leu Ile Pro Ser Leu Asn Ile Gly Leu Asp
65 70 75 80

Glu Leu Ala Lys Ser Gly Gly Gly Gly Glu Tyr Ile Ala Arg Thr
85 90 95

Asp Ala Asp Asp Ile Ala Ser Pro Gly Trp Ile Glu Lys Ile Val Gly
100 105 110

Glu Met Glu Lys Asp Arg Ser Ile Ile Ala Met Gly Ala Trp Leu Glu
115 120 125

Val Leu Ser Glu Glu Lys Asp Gly Asn Arg Leu Ala Arg His His Lys
130 135 140

His Gly Lys Ile Trp Lys Lys Pro Thr Arg His Glu Asp Ile Ala Ala
145 150 155 160

Phe Phe Pro Phe Gly Asn Pro Ile His Asn Asn Thr Met Ile Met Arg
165 170 175

Arg Ser Val Ile Asp Gly Gly Leu Arg Tyr Asp Thr Glu Arg Asp Trp
180 185 190

Ala Glu Asp Tyr Gln Phe Trp Tyr Asp Val Ser Lys Leu Gly Arg Leu
195 200 205

Ala Tyr Tyr Pro Glu Ala Leu Val Lys Tyr Arg Leu His Ala Asn Gln
210 215 220

Val Ser Ser Lys His Ser Val Arg Gln His Glu Ile Ala Gln Gly Ile
225 230 235 240

Gln Lys Thr Ala Arg Asn Asp Phe Leu Gln Ser Met Gly Phe Lys Thr
245 250 255

Arg Phe Asp Ser Leu Glu Tyr Arg Gln Thr Lys Ala Ala Ala Tyr Glu
260 265 270

Leu Pro Glu Lys Asp Leu Pro Glu Glu Asp Phe Glu Arg Ala Arg Arg
275 280 285

Phe Leu Tyr Gln Cys Phe Lys Arg Thr Asp Thr Pro Pro Ser Gly Ala

290

295

300

Trp Leu Asp Phe Ala Ala Asp Gly Arg Met Arg Arg Leu Phe Thr Leu
305 310 315 320

Arg Gln Tyr Phe Gly Ile Leu Tyr Arg Leu Ile Lys Asn Arg Arg Gln
325 330 335

Ala Arg Ser Asp Ser Ala Gly Lys Glu Gln Glu Ile
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<210> 12

<211> 337

<212> PRT

<213> non-Neisseria

<400> 12

Leu Gln Pro Leu Val Ser Val Leu Ile Cys Ala Tyr Asn Ala Glu Lys
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Tyr Phe Ala Gln Ser Leu Ala Ala Val Val Gly Gln Thr Trp Arg Asn
20 25 30

Leu Asp Ile Leu Ile Val Asp Asp Gly Ser Thr Asp Gly Thr Pro Ala
35 40 45

Ile Ala Arg His Phe Gln Glu Gln Asp Gly Arg Ile Arg Ile Ile Ser
50 55 60

Asn Pro Arg Asn Leu Gly Phe Ile Ala Ser Leu Asn Ile Gly Leu Asp
65 70 75 80

Glu Leu Ala Lys Ser Gly Gly Glu Tyr Ile Ala Arg Thr Asp Ala
85 90 95

Asp Asp Ile Ala Ser Pro Gly Trp Ile Glu Lys Ile Val Gly Glu Met
100 105 110

Glu Lys Asp Arg Ser Ile Ile Ala Met Gly Ala Trp Leu Glu Val Leu
115 120 125

Ser Glu Glu Asn Asn Lys Ser Val Leu Ala Ala Ile Ala Arg Asn Gly
130 135 140

Ala Ile Trp Asp Lys Pro Thr Arg His Glu Asp Ile Val Ala Val Phe
145 150 155 160

Pro Phe Gly Asn Pro Ile His Asn Asn Thr Met Ile Met Arg Arg Ser
165 170 175

Val Ile Asp Gly Gly Leu Arg Phe Asp Pro Ala Tyr Ile His Ala Glu
180 185 190

Asp Tyr Lys Phe Trp Tyr Glu Ala Gly Lys Leu Gly Arg Leu Ala Tyr
195 200 205

Tyr Pro Glu Ala Leu Val Lys Tyr Arg Phe His Gln Asp Gln Thr Ser
210 215 220

Ser Lys Tyr Asn Leu Gln Gln Arg Arg Thr Ala Trp Lys Ile Lys Glu
225 230 235 240

Glu Ile Arg Ala Gly Tyr Trp Lys Ala Ala Gly Ile Ala Val Gly Ala
245 250 255

Asp Cys Leu Asn Tyr Gly Leu Leu Lys Ser Thr Ala Tyr Ala Leu Tyr
260 265 270

Glu Lys Ala Leu Ser Gly Gln Asp Ile Gly Cys Leu Arg Leu Phe Leu
275 280 285

Tyr Glu Tyr Phe Leu Ser Leu Glu Lys Tyr Ser Leu Thr Asp Leu Leu
290 295 300

Asp Phe Leu Thr Asp Arg Val Met Arg Lys Leu Phe Ala Ala Pro Gln
305 310 315 320

Tyr Arg Lys Ile Leu Lys Lys Met Leu Arg Pro Trp Lys Tyr Arg Ser
325 330 335

Tyr

<210> 13
<211> 306
<212> PRT
<213> Escherichia coli

<400> 13

Leu Asp Ile Ala Tyr Gly Thr Asp Lys Asn Phe Leu Phe Gly Cys Gly
1 5 10 15

Ile Ser Ile Ala Ser Ile Leu Lys Tyr Asn Glu Gly Ser Arg Leu Cys
20 25 30

Phe His Ile Phe Thr Asp Tyr Phe Gly Asp Asp Asp Arg Lys Tyr Phe
35 40 45

Asp Ala Leu Ala Leu Gln Tyr Lys Thr Arg Ile Lys Ile Tyr Leu Ile
50 55 60

Asn Gly Asp Arg Leu Arg Ser Leu Pro Ser Thr Lys Asn Trp Thr His
65 70 75 80

Ala Ile Tyr Phe Arg Phe Val Ile Ala Asp Tyr Phe Ile Asn Lys Ala
85 90 95

Pro Lys Val Leu Tyr Leu Asp Ala Asp Ile Ile Cys Gln Gly Thr Ile
100 105 110

Glu Pro Leu Ile Asn Phe Ser Phe Pro Asp Asp Lys Val Ala Met Val
115 120 125

Val Thr Glu Gly Gln Ala Asp Trp Trp Glu Lys Arg Ala His Ser Leu
130 135 140

Gly Val Ala Gly Ile Ala Lys Gly Tyr Phe Asn Ser Gly Phe Leu Leu
145 150 155 160

Ile Asn Thr Ala Gln Trp Ala Ala Gln Gln Val Ser Ala Arg Ala Ile
165 170 175

Ala Met Leu Asn Glu Pro Glu Ile Ile Lys Lys Ile Thr His Pro Asp
180 185 190

Gln Asp Val Leu Asn Met Leu Leu Ala Asp Lys Leu Ile Phe Ala Asp
195 200 205

Ile Lys Tyr Asn Thr Gln Phe Ser Leu Asn Tyr Gln Leu Lys Glu Ser
210 215 220

Phe Ile Asn Pro Val Thr Asn Asp Thr Ile Phe Ile His Tyr Ile Gly
225 230 235 240

Pro Thr Lys Pro Trp His Asp Trp Ala Trp Asp Tyr Pro Val Ser Gln
245 250 255

Ala Phe Met Glu Ala Lys Asn Ala Ser Pro Trp Lys Asn Thr Ala Leu
260 265 270

Leu Lys Pro Asn Asn Ser Asn Gln Leu Arg Tyr Ser Ala Lys His Met
275 280 285

Leu Lys Lys His Arg Tyr Leu Lys Gly Phe Ser Asn Tyr Leu Phe Tyr
290 295 300

Phe Ile
305